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[COOLING MECHANISM OF A FORCIBLE OIL COOLING TYPE MOTOR OR GENERATOR]

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(54) Specification

1. [Title of the invention]

COOLING MECHANISM OF A FORCIBLE OIL COOLING TYPE MOTOR OR GENERATOR

(57) [Abstract]

[Topic]

The heat generated by a motor or the coil inside of a motor is efficiently and uniformly enabled to be removed from all over the entire coil surface which covers from the load shaft to the counter load shaft side.

[Solution means]

The cooling hollow hole inside of the rotor shaft
Of the motor or a generator was made in parallel with the traditional rotation shaft core, however, in the present invention, it is designed such that the cooling hydraulic feeding port has a small diameter, and the output shaft side has a large diameter, thus made to be a tapered hollow hole, hence, due to the centrifugal force which acts on the cooling oil, uniform amount of cooling oil flies to the coil from either one of small holes 9a, 9b, thus enabling the efficient coil cooling.

[Scope of the patent claims]

[Claim item 1]

Regarding the structure which forcefully cools hydraulically wherein the inside of rotor rotation shaft is made hollow, into which the cooling oil is force-fed from outside, said cooling oil

flies by the centrifugal force, this cooling mechanism of the forcible oil cooling type motor or generator is characterized such that the inside of rotor rotation shaft is made hollow, and tapered, and the output side of the motor and the drive side of the generator are made to be the large diameter side of the aforementioned tapered hole.

[Detailed explanation of the invention]

[0001]

[Utilized field in industry]

The present invention relates to the cooling oil path structure of rotor rotation shaft of a motor or a generator in which forcible oil cooling method used for electrically driven vehicles and the like is used for higher output.

[0002]

[Prior arts]

Regarding the traditional oil cooling type generator or a motor, as shown in figure 2, hollow hole 07 is made in rotor rotation shaft 012, and a plural number of small holes 09(09a, 09b) are opened on this rotor rotation shaft side surface, the small holes are used to feed the cooling oil. In this structure, cooling oil is force fed into the hollow hole 09, then, from the plural number of small holes 09, by the centrifugal force accompanied by the rotation of rotor rotation shaft 012, it is radially discharged to the outside, and hits the coil 010 inside of the motor or the

generator, and the heat generated by coils are robbed per coil 010.

[0003]

[Problems the present invention attempts to solve]

By the way, regarding the traditional cases, the aforementioned cooling oil was discharged by centrifugal force which accompanies the rotation of the generator or motor, however, the cooling oil amount discharged from the small holes 09 does not become uniform, and the oil amount discharged from the small holes 09b positioned away from the force feeding port 04 became smaller compared with the oil amount discharged from the small holes 09a near from the force feeding port 04, thus causing the non-uniformity of the cooling of coil 010.

[0004]

That reason is that hollow hole 07 is made in parallel with the rotor rotation shaft core 08, the cooling oil 02 which flowed in from the force feeding port 04 aggregated in the small holes 09a near the force feeding port 04, and was discharged, the only small amount of remaining cooling was discharged from the far small holes 09b.

[0005]

Hence, in order to also feed a sufficient amount of oil into the small holes 09b located far from the force feeding port 04, one method can be considered wherein for instance, the supply oil

amount itself of the external hydraulic source 01 can be increased, however, according to this method, it requires another method to increase supply oil amount additionally, and since the oil amount is increased also, oil churning resistance loss inside of the generator or motor is also increased, it is not a gaining measure. However, in the past, this method was used often.

[0006]

As another method to attain aforementioned purpose, the hole diameter of the small hole 09b is made larger than the hole diameter of the small holes 09a, or the hole number of the 09b side is increased more than the hole number of 09a side, thereby, cooling oil amount can be properly distributed, however, making horizontal holes or making many holes in the rotor rotation shaft which transmits the motive force reduces the strength of the rotor rotation shaft, hence, not preferred (however, this method was often used in the past).

[0007]

The purpose of the present invention is to efficiently and uniformly rob the heat generated by the coils inside of the motor or generator over the entire surface of the coil from the load shaft to the counter load side.

[0008]

[Means to solve the problems]

Regarding the forceful hydraulic cooling structure wherein the

inside of rotor rotation shaft is made hollow, into which the cooling oil is force-fed from outside, said cooling oil flies by the centrifugal force,

the cooling structure of the motor or the generator of the present invention is characterized such that the inside of rotor rotation shaft is made hollow, and tapered, and the output side of the motor and the drive side of the generator are made to be the large diameter side of the aforementioned tapered hole.

[0009]

In the traditional examples, the cooling hollow hole of the inside of rotor rotation shaft was processed in parallel with the rotor rotation shaft core, according to the present invention, the force feeding port of cooling oil 04 side was made to have a smaller diameter, load shaft side was made to have the larger diameter, thus creating a tapered hollow hole 7, hence, due to the centrifugal force which acts on the cooling oil, a uniform amount of cooling oil flies into the coil from the small holes of either one of small holes 9a, 9b positions, thus the efficient and uniform coil cooling can be executed.

[0010]

[Embodied form of the present invention]

The following will explain the embodied form of the present invention while referring to the figure 1. Regarding the forcible oil cooling type motor of this invention, the force feeding port

of cooling oil 4 side is made to have a small diameter, and the load shaft side is made to be a tapered hollow hole with a large diameter, hence, due to the impact of the centrifugal force which acts on the cooling oil, hence, due to the centrifugal force which acts on the cooling oil, a uniform amount of cooling oil flies into the coil from the small holes of either one of small holes 9a, 9b positions, thus the efficient and uniform coil cooling can be executed.

[0011]

Figure 1, as previously described, shows the embodied form applied for the permanent magnet type brushless motor of the first embodied form of the present invention. In the following explanation, the state is hypothesized in which the motor is rotating. The cooling oil 2 which was force fed from external hydraulic source 1 flows into the cooling hydraulic port 4 set up at the motor 3. In the vicinity of cooling hydraulic port 4 is set up oil seal 5, thus preventing cooling oil from leaking into the inside of the motor. The cooling oil 2 which flowed in from outside flows into the tapered hollow hole 7 which is made inside of the rotor rotation shaft 6. Regarding aforementioned tapered hollow hole7, the output shaft 12 side is made to be the large diameter hole side of the taper.

[0012]

In the orthogonal direction vis-à-vis the shaft core 8 of the rotor

rotation shaft from hollow hole 7, a plural number of cooling oil spraying small hole 9b, 9a are made with same diameters on the large diameter and small diameter sides respectively. In the state where rotor rotation shaft 6 is in a rotation action, the centrifugal force acts on the cooling oil 2 in the inside perimeter of tapered hollow hole7. This centrifugal force becomes larger than the small hole 9a of the small diameter side in the small hole 9b of the large diameter side, hence, even if the position of the small hole 9b is farther than the small hole 9a, the equal amount of cooling oil flows out form small holes 9b, 9a.

[0013]

As described above, equal amount of cooling oil flows out from small holes 9a, 9b, and flies around and collides with stator coil 10, thus, heat is carried away, thus uniformly cooling the stator coil 10. Next, the cooling oil 2 which cooled stator coil 10 gathers by gravity action in case drain port 11 which is located toward the bottom of the motor, and via oil piping, returns to the external hydraulic source 1 and circulates.

[0014]

Regarding the taper direction when the tapered hollow hole7 is made in rotor rotation shaft 6, as described above, the cooling hydraulic feeding oil port 4 sides, that is, counter output side of the motor is made to be the small diameter side, and the output shaft 12 side of the motor is made to be the large diameter side.

In case tapering processing is done, it is started from the large diameter side and goes to the small diameter side, hence, it is necessary that the output shaft 12 and rotor rotation shaft 6 be made a separate product. Hence, after executing taper processing inside of rotor rotation shaft 6, output shaft 12 and rotor rotation shaft 6 can be joined as a unit by electron beam welding.

[0015]

The above is an applicable example of the present invention for the motor, but in case it is applied to the generator, in the hollow tapered hole of the rotor rotation shaft, if the drive side is made to be the large diameter, the similar cooling method can be adopted.

[0016]

[Effects of the invention]

In the present invention, the structure is adopted wherein the tapered hollow hole is made in rotor rotation shaft, the cooling oil is made to flow thereinto, thereby, the heat generated inside of the motor or generator can be robbed efficiently and uniformly from all over the coil.

[Simple explanation of the diagrams]

Figure 1. It is a cooling mechanism drawing applied for the permanent magnet brushless motor of the present invention

Figure 2. It is a corresponding drawing of the traditional example.

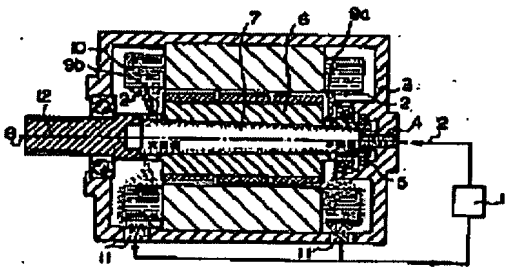
[Explanation of the symbols]

1... external hydraulic source, 2... Cooling oil, 3... A motor, 4... Cooling hydraulic feeding port, 5... Oil seal, 6... Rotor rotation shaft, 7... Tapered hollow hole,

8... rotor rotation shaft core, 9a, 9b... small holes, 10... Stator coil, 11... Case drain port, 12... Output shaft,

01... external hydraulic oil source, 02... Cooling oil, 04... Force feeding port, 07... Hollow hole, 08... Rotation shaft core, 09a, 09b... small holes, 010... Coil, 012... Rotor rotation shaft

【図1】



【図2】